(19) JAPANESE PATENT OFFICE (JP)
(12) Official Gazette for Unexamined Patent Publications (A)

(11) Japanese Unexamined Patent Application (Kokai) No.: S57-102166

(43) Disclosure Date: June 25, 1982

	Identification	Internal Office
(51) Int. Cl.^{3}:	Symbols:	Filing Nos.:
A 23 L 1/36		6971-4B

Number of inventions: 3

Request for Substantive Examination: Not yet submitted

(Total of 3 pages [in the Japanese text])

(54) Method for pulverizing seeds with high fat content, device therefor, and product therefrom

(21) Patent Application No.: S55-176122

(22) Filing Date: December 13, 1980

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SPECIFICATION

1. Title of the Invention

Method for pulverizing seeds with high fat content, device therefor, and product therefrom

2. Scope of the Patent Claims

1. A method for pulverizing seeds with high fat content, wherein said seeds are immersed in liquid gas and subjected to impact cutting in a low temperature atmosphere at 60°C or less.

2. A device for pulverizing seeds with high fat content wherein a seed immersion tank A which encloses liquid gas, the bottom part of which opens inside a tank main body (1) and the upper part of which is provided with a screw conveyor (4) mounted and housed inside a cylinder (7) which projects outward of the tank main body (1), and a grinder B in which are mounted rotating blades (13) for impact cutting seeds which are supplied from a seed supply port (16) via a pipe from an upper part opening (6) of the abovementioned cylinder (7), a protrusion (11) on the inner surface wall of a cylinder (12), and a fan (14) for drawing in powder, are linked by a pipe between the upper part opening (6) of the cylinder (7) and the seed supply port (16); a powder and gas delivery port (18) of the grinder B, and a powder and gas ingress port (20) of a cyclone C are linked by a pipe; and a gas recovery port (22) at the top part of the cyclone C and a circulation gas ingress port (19) of the grinder B are linked by a pipe, with a gas exhaust port (23) being provided midway along said pipe.

3. A fine powder of seeds with high fat content which are immersed in liquid gas, and subjected to impact cutting in a low temperature atmosphere.

3. Detailed Description of the Invention

The present invention relates to a method for pulverizing seeds which contain a large amount of fat, to a device for this purpose, and to a fine powder produced by this method.

It has hitherto been difficult to pulverize seeds which contain a large amount of fat (referred to below as "seeds with high fat content"), such as sesame, walnut, peanut, pine nut, pumpkinseed, and almond, and methods are adopted wherein the seeds are cracked or mashed into a paste as far as possible, but there are disadvantages with these methods in that, for example, as things are, people cannot digest the highly nutritious substances contained in large amounts in the coats of these kinds of cracked seeds, and most of these substances are excreted outside the body; when the seeds are mashed into a paste, the vitamins, minerals etc. in the seeds are modified by the heat generated in the mashing, and the oil and fat component is oxidized, making the substances difficult to absorb by the body and they are easily degraded.

The purpose of the present invention is to alleviate these conventional problems, and to this end it provides a method for pulverizing seeds with high fat content, a device for this purpose, and a fine powder of seeds with high fat content produced by this method, which powder has a high nutritional value and is easily digested and absorbed by the human body.

The method for pulverizing seeds with high fat content according to the present invention is characterized in that seeds with high fat content are immersed in liquid gas such as liquid nitrogen gas or liquid natural gas, after which they are subjected to impact grinding in a low temperature atmosphere of -60°C or less. In this case, liquid nitrogen is preferably used as the liquid

gas because the required low temperature can be easily obtained, it is easily controlled, and furthermore there is no harmful effect on the human body even if the powder from seeds which have been immersed in liquid nitrogen is consumed. The amount of fat contained in different seeds varies, with those containing a larger amount requiring a somewhat lower temperature. Sesame seeds contain approximately 50.9%, and require a temperature of around -70°C, while peanuts contain approximately 46.6% and require a temperature of around -65°C. The lower the temperature, the higher the grinding efficiency, but the material of the device and its structure must also be taken into account. Most seeds with high fat content can be pulverized if the temperature is in the range of around -60°C to -80°C, and it is economical. The seeds with high fat content which are pulverized by the method of the present invention may be either roasted or unprocessed.

A description will be given with the aid of the figures of an exemplary embodiment of a production device which employs the method of the present invention.

In this device, a seed immersion tank A, grinder B, cyclone C, and a liquid nitrogen tank (not depicted) are linked by supply and delivery pipes for seeds and seed powder, and gas.

The seed immersion tank A is provided with a seed release port 2 at the top of a tank main body 1 which is insulated by means of a vacuum wall or an insulating material etc., and with a liquid nitrogen supply port 3; a cylinder 7, running from the bottom part inside the tank main body 1 and projecting through the upper part of the tank main body 1, which houses a screw conveyor 4 for transporting seeds and which comprises a bottom part opening 5 and an upper part opening 6, and

a sensor 8 for regulating the liquid surface of the liquid nitrogen are mounted in said tank. The seed release port 2 is linked, by means of a pipe 9, to a conveyor 10 for conveying seeds. The screw conveyor 4 for transporting seeds may be manual, electric, or a combination of the two.

The grinder B comprises a cylinder 12 having a large number of protrusions 11 shaped like needles or pleats etc., a plurality of rotating blades 13, a fan 14 for drawing in powder, and a motor 15; a seed supply port 16, a liquid nitrogen supply port 17, a powder and gas delivery port 18, and a circulation gas ingress port 19 are provided in the case body of the grinder B. The seed supply port 16 is linked by a pipe to the upper part opening 6 of the cylinder 7 which houses the screw conveyor 4 of the seed immersion tank A; the liquid nitrogen supply port 3 is linked to the liquid nitrogen tank by a pipe; the powder and gas delivery port 18 is linked to the cyclone C by means of a pipe; and the circulation gas ingress port 19 is linked to the upper part of the cyclone C by means of a pipe. A temperature regulation device (not depicted) is mounted in the grinder B and it is linked to the liquid nitrogen tank; it keeps the temperature inside the grinder B appropriately low. The protrusions 11 and the rotating blades 13 are made of a special alloy which can withstand low temperature and impact. The fan 14 for drawing in powder preferably has the same axis as the rotating blades.

The cyclone C is a cyclone having a normal structure provided with a powder and gas ingress port 20 at its upper part, a powder retrieval port 21 at its bottom part, and a gas recovery port 22 at its top part (the internal structure is omitted from the figures), and the powder and gas ingress port 20 and the gas recovery port 22 are linked by a pipe to the powder and gas

delivery port 18 and the circulation gas ingress port 19 of the grinder B, respectively. A gas exhaust port 23 is provided midway along the pipe which links the circulation gas ingress port 19 and the gas recovery port 22.

The pipes which link the seed immersion tank A, the grinder B, and those which link the grinder B and the cyclone C to each other are preferably covered with an insulating material.

When the device according to the embodiment of the present invention is used, seeds with high fat content are supplied by an input conveyor or any other kind of conveyor from the seed release port 2 to inside the tank main body 1 which is filled with a suitable amount of liquid nitrogen, and said seeds are immersed in the liquid nitrogen for 5 to 10 seconds, after which they are transported inside the grinder B by the screw conveyor 4. In this case, the sensor 8 for regulating the liquid surface and the pipe which runs through the liquid nitrogen supply port 3 are linked, and the amount of liquid nitrogen inside the tank main body 1 is regulated to a suitable amount. The seeds which are released inside the grinder B are thrown against the protrusions 11 by means of the rotating blades 13 which rotate at high speed by means of the motor 15, and the seeds are pulverized due to the impact and cutting action thereof; the seeds are drawn toward the powder and gas delivery port 18 due to the rotation of the fan 14, and are delivered inside the cyclone C together with the gas. The seed fine powder in the gas which is delivered inside the cyclone C sinks to the bottom part of the cyclone C due to the action of the cyclone C, the gas is once again sent inside the grinder B via the gas recovery port 22, and some waste gas is discharged from the exhaust port 23. The seed fine powder which has sunk inside the cyclone C is retrieved from the powder retrieval port 21.

According to the present invention, seeds with high fat content are immersed in liquid gas, and therefore they are sufficiently cooled right to the inside and can be easily pulverized by an impact and cutting action, and moreover, the seeds in this fine powder are sufficiently cooled right to the inside by the liquid gas prior to pulverization and pulverized in a low-temperature atmosphere, so the powder is sterilized; vitamins and minerals etc. are not broken down by the heat generated by impact cutting, and the oil and fat do not flow out and the oil and fat component is not oxidized either, and therefore the substance is unlikely to degrade, and it is easily absorbed by the human body. Accordingly, this fine powder retains its component make-up from prior to grinding, and in particular the plentiful nutritious components contained in the seed coats are mostly contained in said fine powder. Thus, since it is a fine powder, it is easily digested and absorbed by the human body even if it is eaten in unmodified form, and furthermore it can be easily processed or added to other foodstuffs. Furthermore, since it is a fine powder, it can be easily housed in any kind of container or packaging, and it can be easily stored and transported etc. In this way the present invention has excellent effects that are lacking in the prior art.

4. Brief Description of the Figures

Figure 1 is a schematic illustration of the device pertaining to the invention of the present application; and Figure 2 is a schematic illustration in cross section along the line a-a.

A...seed immersion tank
B...grinder
C...cyclone
1...tank main body

2...seed release port
3...liquid nitrogen supply port
4...screw conveyor
11...protrusion
13...rotating blade
14...fan
15...motor
18...powder and gas delivery port

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Figure 1

Figure 2